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Functional and radiological outcome of short intramedullary nail for the treatment of unstable pertrochanteric fractures

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Abstract
Introduction: Intertrochanteric or pertrochanteric fractures of the femur are commonest fractures encountered in day-to-day orthopaedic practice and the most devastating injuries of old age. The incidence of this fracture increases with age even though the femur's neck is more common in the oldest.
Aim: Our study aims to assess the radiological and functional outcome of Intramedullary fixation of unstable pertrochanteric fractures with Trochanteric Fixation Nail.
Methods: Patients with unstable pertrochanteric fractures according to Boyd and griffin classification type-2, 3 & 4 injury between 25 to 85 years were included. Study parameters like the interval between injury and surgery, Boyd and griffin classification, operating time, c-arm exposure, blood loss fracture union, unaided weight-bearing, functional outcomes and complications were collected.
Results: Out of 20 patients operating time less than 35mins for 1 patients, 45-60mins for 14 patients, 61-75mins for 3 patients and 76-90mins for 2 patients, fracture union between 6-10 weeks for 14 patients and 11-15 weeks for 6 patients, weight-bearing in 0-6 weeks for 16 patients,7-10 weeks for 2 patients and 11-15 weeks for 2 patients, functional outcome is excellent for 16 patients and good for 4 patients and complications like abductor lurch for 4 patients, screw breakage for 2 patients and screw back out for 1 patient.
Conclusion: The Trochanteric Fixation Nail (TFN) is a versatile load sharing device that can be used for the fixation of unstable pertrochanteric fractures with less blood loss and shorter operating time than the dynamic hip screw.

Keywords: Trochanteric, intramedullary, femur, pertrochanteric

Introduction
The femur's intertrochanteric or pertrochanteric fractures are one of the commonest fractures encountered in day-to-day orthopaedic practice and the most devastating injuries of old age [1]. The incidence of this fracture increases with age even though the femur's neck is more common in the oldest. These patients are more limited to home ambulation and are dependent on basic and instrumental activities of daily living. Population explosion and the increased road traffic accidents have resulted in an enormous increase in these fractures. RTA and fall from height are the main cause of this fracture in the young age, accounting for only ten percent [2]. Older patients with a minor fall can sustain these fractures because of weakened bone due to osteoporosis or pathological fracture, which accounts for 90% of all pertrochanteric fractures [1, 3].
Since the femur is the principal load-bearing bone trochanteric fracture of this bone may result in prolonged morbidity and severe disability unless treated appropriately. About 15 to 20% of patients with this fracture die within one year. After one year patients appear to resume their age-adjusted mortality rate [4]. Until 1960's non-operative treatment was the option available for these types of fractures in the form of traction with prolonged bed rest with fracture healing occurring in ten to twelve weeks (usually) followed by a prolonged ambulation training. These are associated with complications of prolonged recumbency like decubitus ulcer, UTI, joint contractures, lung infections and systemic thromboembolic events resulting in a high mortality rate [5].

Of late a better understanding of the biomechanics of the fracture and the development of better implants have led to radical changes in treatment modalities. Increasing emphasis on the preservation of blood supply by preserving soft tissue around the fragments and autogenous bone grafting has improved biological results. While the development in biomedical research has yielded implants of greater strength and longer fatigue life. With the thorough understanding of fracture geometry and biomechanics, appropriate treatment can be selected on an individual case basis.

Earlier implants like Jewett nail and Holt nail stabilized proximal head and neck fragment to the distal femoral shaft but there was a lack of controlled impaction. The later sliding – nail plate devices like Massie nail and Ken-Pugh nail provided both. Then modification of this resulted in the introduction of sliding hip screws like DHS in which the nail portion was replaced by a screw which was blunt-ended and thread with a large outside diameter to improve fixation in the proximal head and neck fragment and by eliminating sharp edges the risk of screw cutout is minimized. Then the concept of bidirectional sliding came by the introduction of Egger's plate and Medoff plate. The sliding hip screw device with its modification has been used widely and successfully for the treatment of these fractures [6].

In unstable trochanteric fractures where there is a loss of posteromedial cortical contact, when the load is applied increased bending force on the DHS lead to implant failure either breakage, screw cutout or separation of the plate from the shaft [6]. This leads to the introduction of Intramedullary devices which due to its position provides more efficient weight transfer and the shorter lever arm can decrease tensile strain thereby decreasing the risk of implant failure [7]. Zickel and Ender's nails were associated with high complication rates. Zickel nail was later modified and renewed interest is being given to intramedullary fixation with devices like the IMHS (intramedullary hip screw), Gamma nail, Russell – Taylor reconstruction nail, ATN (Antegrade trochanteric nail), TFN (Trochanteric fixation nail) and the PFN (Proximal femoral nail) which have the advantages of operating time which is less, insignificant blood loss and with better biomechanical stability and devices allow earlier mobilization [8].

Aim

Our study aims to assess the radiological and functional outcome of intramedullary fixation of unstable pertrochanteric fractures with Trochanteric Fixation Nail.

Materials and methods

This prospective study was conducted in Govt. Stanley Medical College, from June 2011 to September 2012 in patients with unstable pertrochanteric fractures.

Inclusion criteria: age 20-85 years inclusive, fracture according to Boyd and griffin classification type-2, 3 & 4 injuries.

Exclusion criteria: age greater than 85 years, fracture, according to Boyd and griffin classification type-1, medical contraindications.

All the patients were managed initially with skeletal traction before taking up for surgery. Preoperative templating with AP – Roentgenogram of the injured hip was used to measure the nail diameter and lag screw length. Surgery was done in a standard radiolucent fracture table with the patient in the supine position with the use of an image intensifier. Spinal/Sub Arachnoid block/ General anaesthesia was used for all patients. Third-generation cephalosporin was given I.V one hour before surgery as prophylaxis and continued for 48hrs postoperatively. All the fractures were treated with an initial closed reduction with the medial cortex's alignment in the fracture table. In patients where we could not achieve the anatomical reduction by closed methods we used blunt retractors or Steinman pins as joysticks through a stab incision to achieve reduction. An incision is made and the guidewire is inserted and the guide pin is checked AP and lateral views. The nail is inserted with the help of the jig over the guidewire. Once the nail is positioned the guidewire appropriately is removed and drill sleeve is attached to the jig and through a stab incision over lateral thigh, the drill sleeves are pushed up to the lateral cortex one for compression screw and one for derotation screw. The 2 mm guide pin is then passed into the head & neck using guide pin sleeve. The guide pins are advanced up to 5mm short of the articular surface of the femoral head. The femur's neck and head are reamed using 6.2m and 8mm step-cut reamers, screw length measured by the markings in the reamers. Proximal locking with the compression screw along the inferior part of the neck is done first followed by the superior derotation screw of appropriate length as measured preoperatively & postoperatively. Distal locking is also done with the aid of jig and two distal locking screws.

Study parameters like age distribution, sex distribution, mode of injury, the interval between injury and surgery, Boyd and griffin classification, operating time, c-arm exposure, blood loss fracture union, unaided weight-bearing, functional outcomes and complications were collected.

Results

Out of the 22 patients treated in our institution, 20 patients met the inclusion criteria and different study parameters above mentioned were documented and patients who were not willing to participate in the study during follow up period were excluded from the study.

Out of 20 patients duration of operating time less than 35mins 1patients, 45-60mins 14 patients, 61-75mins 3 patients, 76-90mins 2 patients.

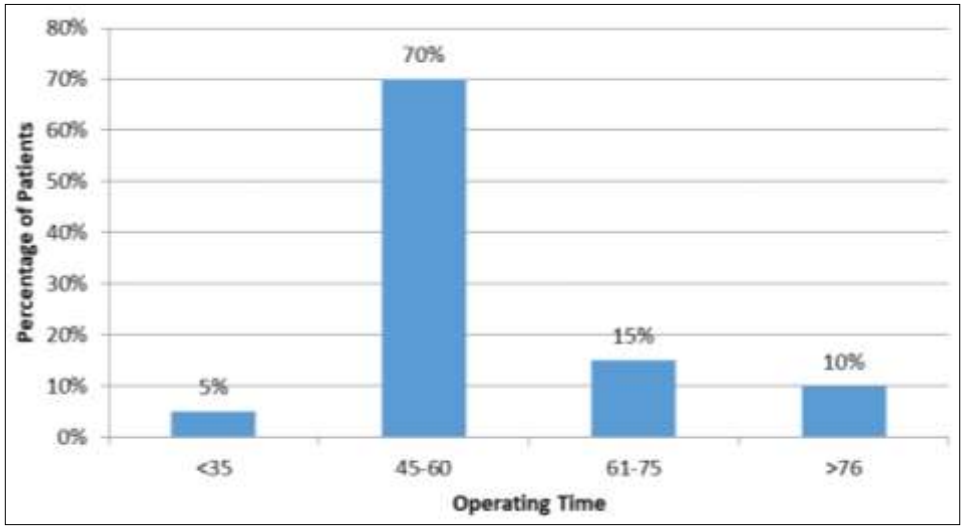

Fig 1: Distribution of operating time

Out of 20 patients 14 patients had fracture union between 6 -10 weeks, 6 patients between 11-15 weeks and 0 patients between 16-20 weeks.

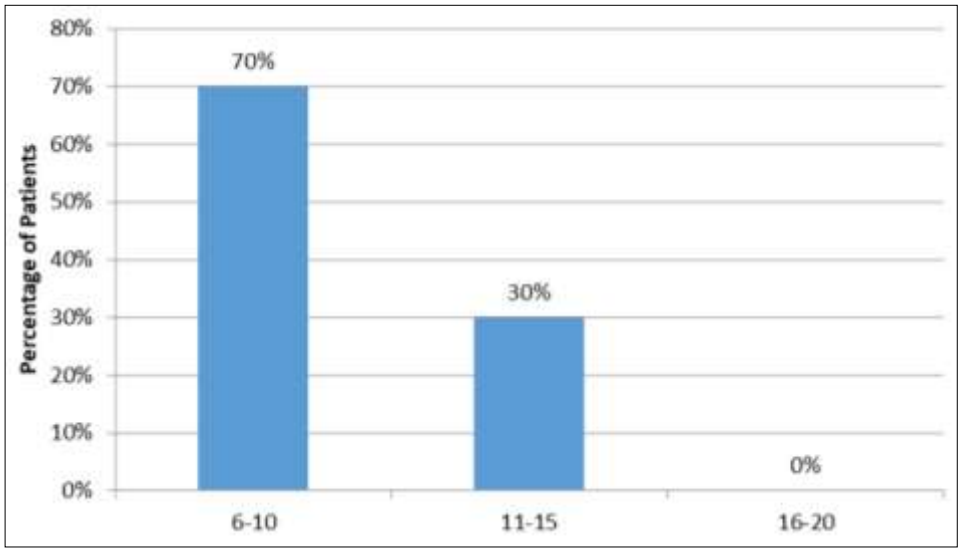

Table 2: Distribution of fracture union

Out of 20 patients 16 patients had weight-bearing between 0-6 weeks, 2 patients between 7-10 weeks and 2 patients between 11-15weeks.

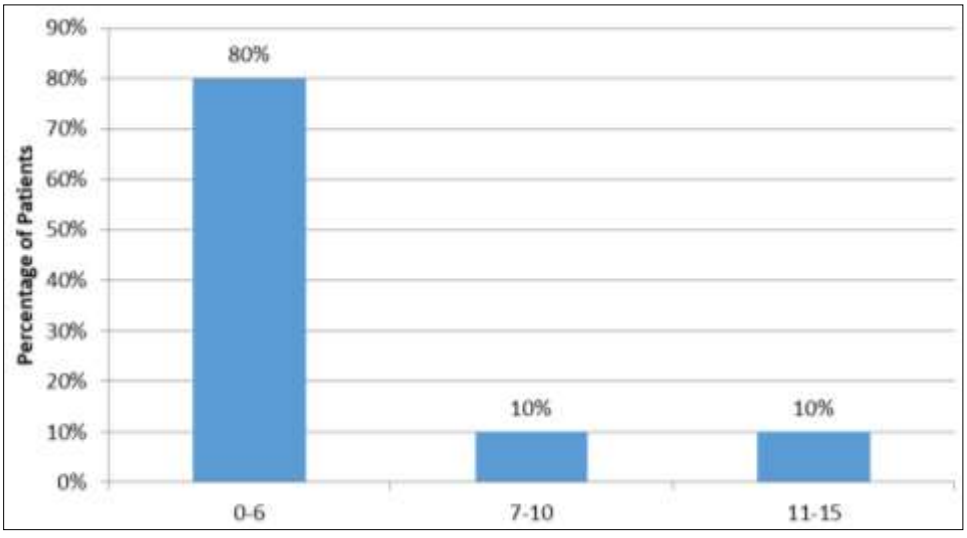

Fig 3: Distribution of weight-bearing

Out of 20 patients functional outcome based on kyles criteria is excellent for 16 patients and good for patients.

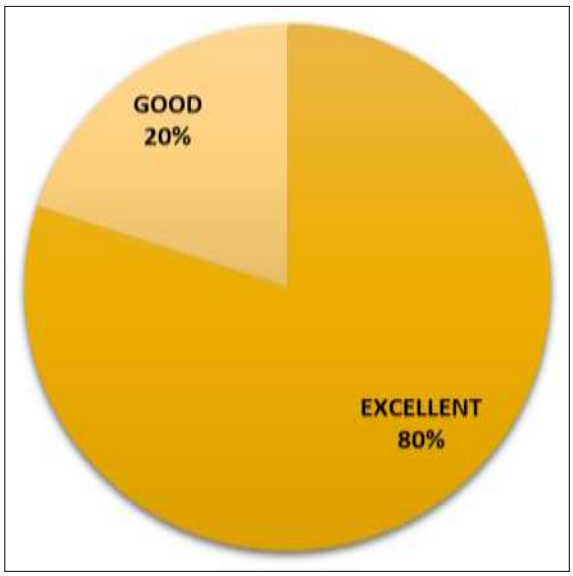

Fig 4: Distribution of functional outcome

Out of 20 patients 4 patients had abductor lurch, 2 patients had screw breakage, 1 patient had screw breakout.

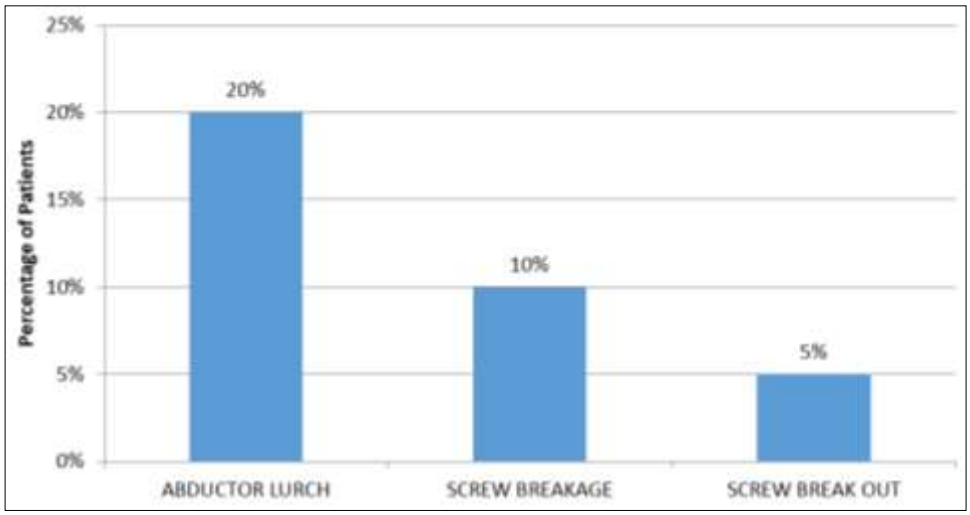

Fig 5: Distribution of complications

Discussion

The treatment of comminuted unstable trochanteric fractures with Dynamic Hip Screw (DHS) is associated with high rates of failure like varus collapse and screw cut out (Rosenblum *et al*. 1992) [7] which led to the development of newer implants like intramedullary nails which are advantageous in such fractures. In our series there was no incidence of varus collapse or screw cut out. There was one incidence of screw back out n=1 (5%).

TFN being intramedullary it is more efficacious in osteoporotic fractures. In our series there were 8 cases (n=8, 40%) who were more than 60 years and there were no implant-related complications with good functional outcomes. The TFN (indigenous) is less costlier than the Gamma nail and imported Proximal Femoral Nail, which adds to its advantages in our population's prevailing economic condition.

Shorter operating time, minimal blood loss, early unaided weight-bearing are all advantages of TFN. Intramedullary nails had minimal per operative blood loss, shorter operative time and early weight-bearing than DHS (Leung *et al*. 1992). [9]. In our series the operating time average duration was 55mins.In initial cases the duration was longer, with experience it came down. This time duration was better than the study by Morihara *et al*. (2007) [10] in which it was 71mins.The average blood loss in our series was 121 ml which was lesser than the blood loss for PFN and Gamma nail which were 220ml and 287 ml respectively (Schipper *et al*. 2004) [11].

The mean duration of hospital stay was 7 days (ranging from 3-18 days) in our series. In the series by bridle *et al*. 1991, [12] the duration was 39 days for DHS group 7. At the end of 4 weeks all but one patient were mobilized in walker with one patient advised non-weight bearing owing to lack of purchase of lag screw in the neck but he was not reoperated as the fracture started to show evidence of radiological union, we planned delayed weight-bearing in that patient. There was no incidence of screw cut out or lateral migration of hip screws in our series in the early postoperative period.

The patients were followed up 4 weekly up to 3 months, 6 patients x rays showed fracture consolidation by 8 weeks,8 cases by 10 weeks and the rest of the six by 12 weeks with a mean of 11 weeks which is better than the results in the series

of Schipper *et al*. [11] and Bridle *et al*. [12] and follow up at 6 months, 2 patients who had screw breakage were reviewed at 6 months and they were doing well functionally, one of them a homemaker was able to do her household activities and the other one was able to do cycling which his job requires to do without difficulty. All the 20 patients were able to walk unaided at the end of 6 months in our series whereas only 60% of the patients were able to do so when fixed with DHS (Dominique *et al*., 1994) [13]. Even at the end of one year only 83% of the patients were bearing full weight in their series.

The kyle's criteria [14, 6, 15] was applied to assess the functional outcome in all the 20 patients at 6 months.80% of the patients had an excellent outcome and 20% had a good outcome with no patients under the criteria of fair or poor outcome which is comparable to 90% of good or excellent outcomes in the series by Gadegone *et al*. 2010 [15]

At one year 12 patients were available for followup the other 8 did not turn up for follow up, there were no specific symptoms and complications related to the implant and the fixation.60% of the patients went to their pre-injury occupation which was better than 50% results in the series by Gadegone *et al*. [15]

Historically the rate of implant failure in unstable trochanteric fractures fixed with DHS is 20% [16], whereas in our series no incidence of implant failure like screw cut out, lag screw breakage, Z-effect of screws with joint penetration, nail breakage was noted. In the series by Schipper *et al*. (1994) [11] the screw cut out rate was 7% in both the PFN and Gamma nail group.

Conclusion

The Trochanteric Fixation Nail (TFN) is a versatile load sharing device that can be used for the fixation of unstable pertrochanteric fractures with less blood loss and shorter operating time than dynamic hip screw which has been the implant of choice so far in these fractures. Functionally the TFN is superior to DHS and Gamma nail in unstable trochanteric fractures with earlier unaided weight-bearing and earlier return of the patients to their pre-injury occupation with lesser pre and postoperative complications. As most of the time the fracture is reduced by closed or joystick reduction measures there was less soft tissue dissection hence the vascularity of the fragments is maintained which leads to an earlier radiological union than that occurs with extramedullary fixation. But TFN needs careful preoperative planning and requires technical skills of the surgeon and the technique has a steep learning curve. The indigenous nail used in our series is cheaper than the imported Gamma nail and Proximal Femoral Nail without compromising the biomechanical qualities.

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